AVIATION

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Phosphorus Bomb Dropped by Martin Bomber, Hitting the Crow's Nest of the Alabama

VOLUME XII
Number 11

SPECIAL FEATURES

THE AERODYNAMICAL LABORATORY OF M.I.T.

BRITISH REPORT ON THE LOSS OF R38

PROPERTIES OF TWO AEROMARINE AEROFOILS

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Balloon Records

THE forthcoming balloon races call attention to the fact that the three classes of world's balloon records recognized by the F.A.I. are at present all held by German nationals, who established them before the late war. The existing world's distance and duration records (1897 miles and 87 hr respectively) were made in 1913 and 1914, while the altitude record of 34,430 ft., was made as far back as 1901.

The present American records are all over ten years old, the distance record (1173 miles) having been made by Alan R. Hawley and Augustus Post in 1910 during the fifth Gordon Bennett Balloon Race, which they won, while the duration (48 hr 26 min.) and altitude (16,000 ft.) records were established by Clifford B. Harmon in 1909.

Since the greatest width of the United States along a parallel of latitude is over 3000 miles, while diagonally it is about 4500 miles, it will be seen that American aeronauts have a splendid opportunity for beating the existing records. That these are not likely to be beaten for some time to come by European balloonists seems probable, for in Europe as here prevailing winds blow from the West, and a landing in the heart of Russia under present conditions might prove a hazardous enterprize.

All these points should serve as a powerful incentive to American aeronauts for an attempt to beat the present world's records. The main difficulty in this respect is undoubtedly that of finances, for the equipment and the preparations required for such a flight entail a considerable outlay, such as may be beyond the means of the average amateur balloonist. For this reason it is suggested that the Army Air Service and Naval Aviation undertake to carry out the project as part of the training activities of balloon pilots. That a series of such flights, from the Pacific to the Atlantic, would offer unparalleled opportunities to Army and Navy aeronauts for displaying their skill and endurance goes without saying. The two services could furthermore create a healthy spirit of rivalry by making such attempts in competition with one another.

Inflammability of Airships

THE R38 and Roma disasters, although due to different causes, naturally focus attention on the fire which was the one common element of both. In both cases the ships would have been complete wrecks without the fire, but with the loss of few if any lives. In neither case was there any explosion, except of gasoline tanks, but the extremely rapid spread of the flames left little chance for escape.

The most obvious remedy and perhaps the only one for small blimps is, of course, the use of helium gas. For larger ships, of say 1,000,000 cu. ft. or more, there is another solution of the problem which seems to hold even better promise than helium. This is to make the envelope itself fireproof, which for all ordinary purposes would make hydrogen as safe as helium. Even a slow burning or so called "flame-resisting" fabric would be immensely safer than the very inflammable materials used at present. Not only would they be more resistant to external ignition, but a hydrogen fire once started would spread much more slowly.

In either case, helium or fireproof envelope, no aircraft will be entirely safe from fire until we have satisfactory heavy oil engines. It looks to us as if all three lines of development should be prosecuted with almost equal vigor, i.e., helium, fireproof envelope, and heavy fuel. Any two of these together should be sufficient to make an airship safe from fire.

Important Decision by Supreme Court

WHILE relating to the regulation of railroad fares, a decision rendered by the Supreme Court through Chief Justice Taft, may have an important effect on pending air legislation.

While "interstate and intrastate commerce are ordinarily subjected to regulation by different sovereignties," the Court explained, "yet when they are so mingled together that the supreme authority, the nation, cannot exercise complete effective control over interstate commerce without incidental regulation of intrastate commerce, such incidental regulation is not an invasion of State authority."

The breadth of this decision is so important in its possible effect on pending air legislation that it should be given the most complete study. The states' rights theory as it affects aeronautical law has been the greatest obstacle to general federal legislation on the subject.

It will not be difficult to show that state air control would be so mingled together that the federal government cannot exercise complete effective control over aircraft interstate commerce. With forty-eight different air laws in effect and federal legislation attempting to coordinate them, it is clear that pilots will be under the greatest difficulty in regard to registration, licensing and air rules.

The Last R38 Report

SERIOUS as were the findings of the committee appointed by the British Air Ministry to investigate the causes of the loss of the R38 (ZR2), it may still be inferred by a casual reader that the causes of the disaster were general rather than specific. That a ship should break in the air does not *necessarily* mean that the design or the construction were faulty. For example, even a well designed airplane can easily be broken in the air by pulling it too suddenly out of a nose dive. It is also conceivable that an airship might intentionally be built to withstand only a limited turning force.

That the chief designer himself was on board the R38, however, presumably directing the tests, makes it clear that "something slipped" somewhere. That is the outstanding fact, which the various contributing factors brought out by the Aeronautical Research Committee only serve to strengthen.

The Aerodynamical Laboratory of the M.I.T.

Recent Additions of Two New Wind Tunnels Greatly Increase Operating Capacity of America's Oldest Research Establishment

By Edward P. Warner

Associate Professor in Aeronautical Engineering, Massachusetts Institute of Technology

As is well known by all those who have followed American aeronautics since the early days, the aerodynamical laboratory of the Massachusetts Institute of Technology has been in continuous operation longer than any other wind tunnel installation now in use in this country. The first wind tunnel was constructed in 1913 under the direction of Comdr J. C Hunsaker, U.S.N., and has been fully described on many occasions.*

The rapid progress in the design of wind tunnels and in the technique of wind tunnel operation, and particularly the increase in wind speed and size of models tested has, however, made evident the desirability of greatly increasing the capacity of the laboratory, and steps have therefore been taken to put into operation two new wind tunnels. The two tunnels are installed side by side in a building constructed during the war for use in connection with the Army and Navy ground schools. The old 4 ft tunnel was set up in this building in September, 1918, having been moved from the ground where it was originally erected, and it has now been dismantled to make room for the new equipment

The New Wind Tunnels

Of the two new wind tunnels one is 4 ft in diameter, the other 7 ft. 6 in The construction of the smaller one was authorized by the governing body of the Massachusetts Institute of Technology in May, 1921 Actual construction was commenced about August 1, and the tunnel went into full operation late in October, the constructional work thus being completed in about three months The larger of the two tunnels is now under construction and its completion is expected about March 15, 1922.

The smaller of the two tunnels, the one which is now operating regularly on work for the Army, on commercial testing, on instruction of students and on pure research, is, as already mentioned, 4 ft. in diameter The motor employed is rated at 10 hp and when running at a 40 per cent overload gives the wind speed of 60 m.p.h The energy ratio† is thus 1 31 as compared with 1.53 for the wind tunnel of the National Advisory Committee for Aeronautics at Langley Field ‡, 0 40 for the 7 ft. N P L. wind tunnel ¶, and 1.09 for the tunnel of the Aerodynamische Versuchsanstalt at Gottingen §. The energy ratio for the old 4 ft. tunnel was 0 48 and has therefore been raised by 173 per cent. These figures are based on power input to the driving motor

The superiority of the N.A C A. tunnel over that at M.I T., so far as efficiency of the tunnel proper is concerned, is therefore less than would appear from the above figures, as the Langley Field power plant is much more modern and better suited for its work than is that of the Massachusetts Institute of Technology and the percentage of motor losses is accordingly less in the first case than in the second. Furthermore, the drive at most of the other tunnels mentioned is direct by shaft whereas at M.I T it is through a silent chain running in the open and this causes a further loss of power between the motor and the propeller This great improvement has been effected primarily by a change in the forms of the entrance and exit cones and in the length of the parallel portion of the tunnel.

It has been shown by Eiffel** that the efficiency of a wind tunnel is primarily dependent on the ratio of length to diameter and particularly on the form of the exit cone, an exit cone of very small vertex angle being most efficient††. The maximum efficiency is realized, at least in theory, (and theory in this respect checks very well with the practice in all cases where the opportunity for comparison has arisen) with a vertex angle of about 5 deg. for the exit cone. The limitations imposed by the length of building are usually such that it is impractical to make the angle as small as this, but it can be made very much smaller than was the case of the old type of wind tunnel The general nature of the change in form is indicated in Fig 1, where longitudinal sections through the old and new 4 ft tunnels are plotted to the same scale. It will be seen that the total lengths are nearly the same in the two cases, but that most of the length goes into the exit cone in one instance, while in the other a larger part of it is devoted to a parallel portion which, contributing nothing but friction, is detrimental to efficiency although helpful in securing regularity of flow Of course, all real wind tunnels are essentially venturi tubes, but the similarity of form to the familiar air-speed measuring instrument is especially marked in the new M I T installation

Constructional Details

The form and constructional detail of the new wind tunnel are shown in Figs 2, 3 and 4. Perhaps its most notable feature is the method and materials of construction employed, which are quite different from any previously used.

The three main portions of the tunnel are all made up by different methods The parallel portion at the throat is planked in the usual way, the 1 in planking being laid inside of rings built up from plywood. The entrance cone is made of plaster laid over wire lath The plaster was formed by hand in accordance with a template of entrance cone curvature and follows the prescribed curve with great accuracy The surface of the plaster is, of course, of perfect smoothness and it seems to furnish the ideal structural material for wind tunnels where the vibration is not excessive and where it is not necessary to walk about or rest heavy objects on the surface, particularly if the surface has a double curvature of a more or less complex nature difficult to form in wood. It was felt, however, that it would be unwise to use plaster for the exit cone as that portion of the structure is much more liable to be affected by motor and propeller vibrations. This exit cone is also straight in form, as will be noted in Fig 1, and its construction therefore offered a relatively simple problem geometrically It was made up of birch veneer laid over rings similar to those employed on the parallel portion and the entrance cone, the veneer being cut in sheets about 6 ft. by 3 and nailed in place on rings and longitudinal stringers. The plywood employed was made up of 3 1/28 in. sheets of veneer, giving a very light and cheap construction which has, however, proven satisfactorily rigid

The tunnel is supported on a light steel framework, the frame itself being trussed so that no stresses come on the tunnel proper The power plant is the same as that used in the old 4 ft tunnel There is a motor-generator unit consisting of an induction motor directly connected to a direct current generator This generator furnishes D C to the motor which drives the propeller through a silent chain. The use of D C of course permits a wider and easier variation than could readily be obtained otherwise The propeller and its sprocket are carried on a steel A frame and a concrete pier. The propeller, which has four blades of constant width, is 7 ft 6 in in diameter, and was especially designed for this service by W H Miller and constructed of oak by the American Propeller and Manufacturing Co It is probable that the improved performance of the tunnel as a whole is due in considerable part to the increased efficiency of the propeller A wire screen is stretched across the exit cone just in front of the propeller in order to catch any models which may break away from the spindle, or any loose objects which may inadvertently be left on the floor of the tunnel and which might otherwise fly into and destroy the propeller

Returning from the power plant to that portion of the tunnel where experiments are actually carried out, some attention must be given to the provision for straightening the flow of air High efficiency in a wind tunnel is, of course, useless without some provision for securing a straight and uniform flow It has been demonstrated by experiments on model tunnels ‡‡ that the only device which gives any large measure of satisfaction in straightening out the flow is a honeycomb, which may be placed in the parallel portion at its juncture with the entrance cone, as in the N.P.L. tunnels and most others, or at its juncture with the exit cone, as is now the case in the tunnel of the National Advisory Committee for Aeronautics, or at the mouth of the entrance cone, as in Professor Prandtl's laboratory at Gottingen and in the Laboratoire Eiffel at Auteil A honeycomb in any of these three locations is extraordinarily effective in straightening out the flow and no other device for this purpose is necessary when a honeycomb is used, provided there is no obstruction close to the tunnel at any point in the room

In the tunnel of the Massachusetts Institute of Technology the honeycomb is placed at the juncture of the parallel portion and the entrance cone, being about 3 ft. up-wind from the model It is made up of galvanized iron pipes 3 in in diameter and 18 in long The straightening of flow which result is very satisfactory Although the air current is not quite as regular as in the old tunnel it apparently does not fluctuate in direction with time over 0 1 deg The measurements made are not seriously affected by this fluctuation In order to permit of ready access to a model a large door is placed on one side of the tunnel and a pane of glass is set therein to facilitate inspection during the progress of the test. There is another window also in the top of the tunnel

To Build a New Balance

At present, the balance used is the same as that employed in the old 4 ft tunnel, but this is not satisfactory at high speeds, as the model is supported on only one point on the

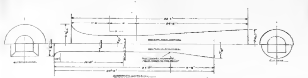


Fig 1 Diagrammatic comparison of old and new M.I.T wind tunnels

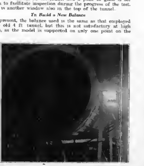


Fig. 2 (Left)—A view of the small M.I.T. wind tunnel. Fig. 3 (Right)—Propeller end of the large M.I.T. wind tunnel

* "The Wind Tunnel of the Massachusetts Institute of Technology" by J. C Hunsaker, Smithsonian Misc Coll. Volume 62 No 4 (Reports on wind tunnel experiments in aerodynamics) page 1

† "Design of Wind Tunnels and Wind Tunnel Propellers" by Edward P Warner, F H Norton and C M Hebbert. Report No 73 Fifth Annual Report, National Advisory Committee for Aeronautics, page 562 Washington, D C 1920

‡ "National Advisory Committee Five-Foot Wind Tunnel" by F H Norton S. A. E Journal, Volume VIII, page 489 (May, 1921)

¶ "Technical Report of the British Advisory Committee for Aeronautics for 1916-17 page 2

§ "Ergebnisse der Aerodynamischen Versuchsanstalt zu Gottingen" by Dr L. Prandtl, pages 9 and 13. Berlin 1921

** "Resume des Principaux Travaux Executes Pendant la Guerre au Laboratoire Aerodynamique Eiffel" 1915-18 by G Eiffel. Page 164 Also "Note sur le calcul des coefficients d utilisation des buses pour souffleries aerodynamiques systeme G Eiffel" by G Eiffel Section Technique Aeronautique, Paris, 1918.

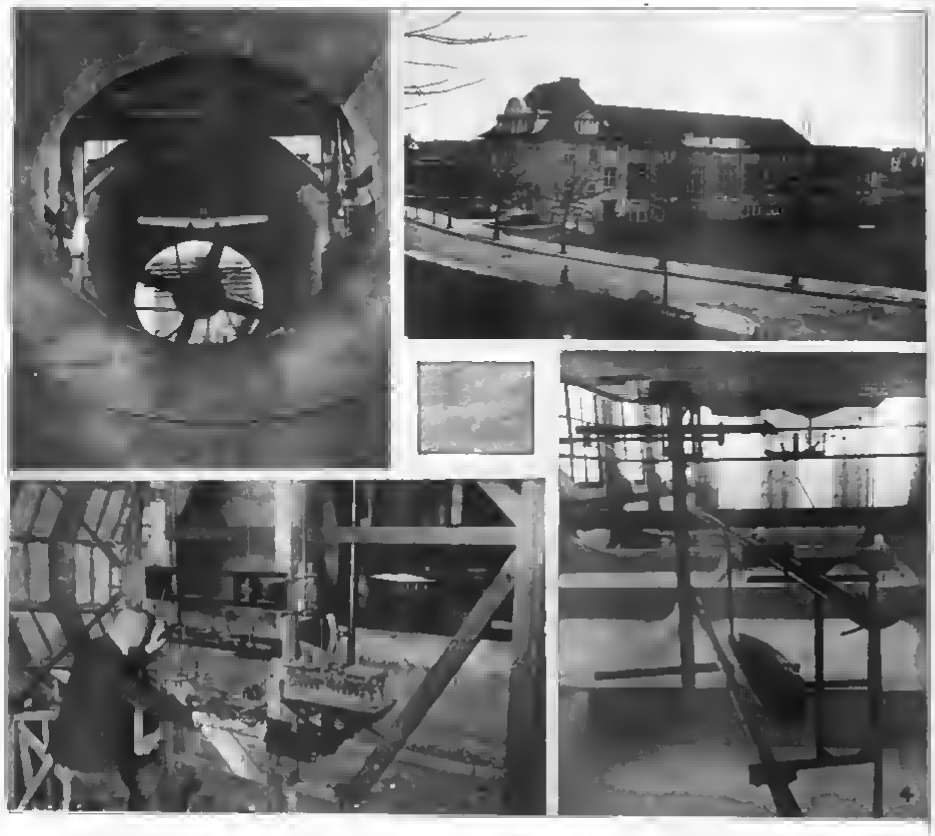
†† A simplified discussion of wind tunnel theory and a chart showing the efficiencies obtainable with various forms is given in "The Design of Wind Tunnels and Wind Tunnel Propellers" by Edward P Warner, F H. Norton and C. M Hebbert Report No 73 National Advisory Committee for Aeronautics, page 565, Washington, D. C. 1919

‡‡ Design of Wind Tunnels and Wind Tunnel Propellers II by F H Norton and Edward P Warner Report No 98 National Advisory Committee for Aeronautics, Washington 1921

N P L. balance and vibrates excessively at over 40 m.p.h. It is therefore intended to construct in the near future a specially designed wire balance of a type in general similar to that now largely used by the National Physical Laboratory in England.

Tests of the same model in the old and the new wind tunnels show on the whole very good agreement, particularly in respect of lift, and the fact that so excellent a degree of coincidence can be obtained between tunnels of such different type is very encouraging and leads to an increased belief in the value of wind tunnel tests, as one of the greatest criticisms that has been made in the past has been that laboratories too often were unable to agree among themselves on the performance of any wing or other model. The description of the large wind tunnel will be reserved for a later article.

The Goettingen Aerodynamical Laboratory



The Goettingen Aerodynamical Laboratory, of which several views appear above, is Germany's oldest and foremost aeronautical research establishment. It owes much of its fame to the research work conducted under the supervision of Professor Prandtl, who is one of the world's leading investigators of the science of aerodynamics. Fig. 1 shows the model of a Brandenburg seaplane suspended in one of the wind tunnels, while Fig. 3 illustrates the instrument control station. The method of testing full sized aircraft parts is shown in Fig. 4. Fig. 2 is a general view of the testing establishment.

There are two wind tunnels in the Goettingen Laboratory: a large one having 4 sq. m. cross area and a maximum air speed of 53 m./sec., and a small tunnel of 1 sq. m. cross area, with a maximum air speed of 33 m./sec.

British Report on the Loss of Airship R38

Findings of Aeronautical Research Committee Attribute Accident to Inaccurate Calculations, Faulty Design and Structual Weakness

The official report on the investigation by the British Aeronautical Research Committee (formerly known as the Advisory Committee for Aeronautics) on the loss of the British rigid airship R38, also known as the U. S. Navy ZR2, has reached the Navy Department and was released recently. Following the destruction of the R38 over Hull, England, on Aug. 24, 1921, with a total loss of forty-four British and American officers and men, a board composed of Sir Richard Tetley Glazebrook, chairman, Sir Joseph E. Petavel, vice chairman, Prof. L. Bairstow, Wing Cdr. W. D. Beatty; Air Commodore H. R. M. Brooke-Popham, Wing Cdr. T. R. Cave-Brown Cave; Prof. J. D. Cormack, Prof. W. E. Dalby; Lt. Col. E. Gold, Prof. B. M. Jones, Prof. Horace Lamb, A. Ogilvie, J. D. Siddeley; H. White, G. I. Taylor and H. T. Tizard, made a report from which excerpts follow:

Introductory

The following report is submitted in accordance with a letter from Air Vice-Marshal Sir Edward Ellington, Director General of Supply and Research, Air Ministry, requesting "that the Accidents Investigations Sub-Committee may carry out an investigation of all technical details which contribute to the recent accident to H. M. airship R38."

In the course of the investigation sixteen meetings have been held. The Committee were fortunate in having before them at the outset the proceedings of the Court of Inquiry set up by the Air Ministry immediately after the accident. These proceedings contain the evidence of eyewitnesses, that of those responsible for the design, construction and trials of the ship, and that of the survivors—with the exception of Flight Lieutenant Wann, who was in command at the time of the accident, but whose state of health prevented him from giving evidence at the time of the inquiry. His evidence was taken later by the Committee along with other evidence additional to that contained in the proceedings of the Court of Inquiry.

Toward the end of their investigation the Committee had also before them the report of the Admiralty Committee of Inquiry into the history of the design and early stages of construction of the R38.

The Preliminary Design Work

Weekly conferences of the design staff of the Royal Airship Works were held during the construction of the ship, but it should be noted that the basis of calculation of the strength of R38 was never officially discussed by experts other than those serving under the late Mr. Campbell. Nevertheless, the lack of aerodynamic data was known to Mr. Campbell, who pressed for full scale experiments to determine these.

At the request of the Airship Design Department of the Admiralty, an investigation had been undertaken by the National Physical Laboratory in order to obtain information regarding the aerodynamic characteristics of R38. A report (Note.—T 1470. Experiments on a model of an airship of the R38 class.—By R. Jones, M. A., and D. H. Williams, B. Sc.) dated May, 1920, was issued which indicated that the resistance of R38 compared unfavorably with that of R33, that fins also appeared to be less effective than those of R33. This report showed that an examination of the stability of the airship showed that, though somewhat unstable, her stability was an improvement upon that of R33, and, moreover, that her controls were much more powerful. In spite of this, as observed previously, she proved, in fact, to be less controllable than R 33.

R38 had Insufficient Margin of Strength

If the bending moments on airships due to aerodynamic forces only are considered, the committee estimate that the increase in strength required by R38 over, say R33 on account of the larger size of R38, should have been 26 per cent, while that required on account of greater speed should be 39 per cent, a net increase of 65 per cent. The assumptions made in arriving at these figures are that the aerodynamic moments vary as the diameter of the ship and the square of the length and of the speed, ignoring for the moment the differences in the aerodynamic characteristics of the two ships. The chief of these differences so far as stressing of the ship is concerned, lies in the control surfaces, which, as has been mentioned, in R38 were of new design.

Model experiments are in accordance with general experience on controls in showing that the R38 type of rudder and elevator is considerably more powerful than the R33 type. Further, with the R33 type of control the rates of increase of moment with control angle fall off rapidly above about 15 deg. to 20 deg. angle of control, whereas with R38 the moment continues to increase, though slightly less rapidly, up to angles as great as 30 deg.

A rough comparison of the aerodynamic bending moments in R33 and R38 when the rudders are moved rapidly over in straight flight, shows that the strength required in R38 was of the order of double that required in R33. In fact, however, the moment of resistance to bending offered by the two ships was about the same.

It thus appeared to be clearly established that R38 had an insufficient margin of strength to withstand the stresses due to maneuvers which might occur during normal flight, or due to bad weather.

In view of this conclusion and since there appeared to be no good grounds for regarding atmospheric conditions as contributing to the accident, it became of importance to examine the nature of the maneuvers which the ship had undergone prior to the accident, particularly on the last flight and immediately before the accident.

Midship Girders Failed

During the first and second flights the speed of the ship and the maneuvers through which she was put were not such as to subject her to very severe stresses. On the third flight, however, it was found that when the speed was increased to 50 knots there was difficulty in keeping a steady height, and 'hunting' through a range of 500 ft. took place. This was corrected in great measure, but immediately afterward word was received in the control car that certain girders amidships had failed.

The opinion that this failure was due to the action of the slipstream of one of the air screws in causing pressure on the structure is not accepted. The committee has formed a different opinion as to its probable cause. The general direction of the slipstream is parallel to the surface of the ship, and its action would not produce appreciably increased pressure, whereas the fact that the ship 'hunted' implied large movements of the elevators in navigation.

Furthermore, the stresses in the ship due to movement of the elevators would be accentuated by the additional stresses due to gas pressures involved in the rapid changes of height as a result of 'hunting.' The committee is of the opinion that the buckling then reported was significant as being the first indication of the existence of dangerous stresses, and that the action of Flight Lieutenant Pritchard, who steadied the ship and relieved these before the failure spread, thus saved the ship.

From the evidence, it is clear that during the last half hour before the accident, the ship was swinging about at an approximately straight course, executing, alternately, partial turns to port and starboard. As to the magnitude and rapidity of the movements of helm, evidence in detail has been taken

According to Flight Lieutenant Wann, who was in command of the ship and standing next to the two men who were operating the rudders and elevators, he was trying the ship on a few short turns to see how she answered her rudders. He had ordered two or three turns with ten degrees of helm and two turns with fifteen degrees. (NOTE—This is consistent with evidence of various eyewitnesses.)

Owing to the length of cable between the control car and rudders, stretch of the control wires and the existence of a tautening spring, the movement of the rudders did not correspond strictly with that shown by the indicator in the control car, and would be greater in the case of over-balance and less in other cases. There had just been completed 50 deg of turn with 15 deg of helm when the accident occurred. He stated that there was no reversal of helm, that is to say, before putting the helm over from port to starboard or the reverse, the helm was put amidships for a brief interval.

From the consideration of the observed pressures over the rudder the committee deduce that during the last half hour of flight there was at least one occasion when the rudder was moved fairly rapidly through an angle, the magnitude of which, as far as it affected the bending moment on the ship, was equivalent to about 20 deg either in straight flight from the amidships position or in circling flight from some position on one side of the amidships position. The actual movement of the rudder might have been greater or less than this, according to whether or not the airship had a swing on at the time the rudders were put over.

Since the evidence before the committee shows the movement of the controls to have been legitimate, the accident is ascribed to the strength of the structure being inadequate.

It is not impossible that the process of failure was gradual and that the final breakage was the cumulative effect of a number of reversals of stress of magnitude not far short of the failing stress.

Lack of Supervision

The question of the possibility of the accident having been due to faulty structural material has been examined. Many samples of material taken from salved girders and joints have been subjected to microscopical examination, chemical analysis and mechanical test at the N.P.L. With the exception of certain of the plates employed in making up girder joints all the samples gave results in accordance with the specifications.

Tests of web plates taken from three salved joints, two of which had two plates each and one had four, showed that one of the plates at each joint was in the soft condition. It was found possible to bring these plates to normal strength by applying the proper heat treatment. Nevertheless, it is thought that these plates did not contribute to the accident, since the parts found soft were not apparently subject to heavy tensile stress, and no evidence was found of defective material in the airship except as above.

Although the committee does not consider it probable that the accident was connected with the existence of these soft web plates, their presence in the ship indicates a certain lack of supervision during some period of the construction. Several samples of plate taken from the store of the Royal Airship Works, Cardington, subsequently to the accident were found to meet the requirements of the specification, and it would appear probable that the softening was effected during the construction of the ship.

Remelted Duralumin Used

Toward the end of the construction of R38 a limited quantity of 're-conditioned' or remelted duralumin was made at Cardington and rolled into sheet. Some of this was used for subsidiary parts of the structure of R38, but none was used on the main structure. In all cases of tests of this material it satisfied the requirements specified for duralumin.

The committee considers that under the most efficient system of manufacture a material as sensitive to heat treatment as duralumin is can provide a reliable airship structure, but the stringency of the conditions required add greatly to the necessity for careful and constant supervision during construction.

Among the points noted in the findings of the Court of Inquiry, held immediately after the accident to R38, was the fact that the outbreak of fire in the forward portion was mainly responsible for the large loss of life; and further, that the fire probably originated in a spark from the electric leads, which became fractured at a point in the immediate vicinity of a similar fracture in the gasoline mains.

The committee accept the findings of the court in this connection, and wish to emphasize the desirability in future airships for all possible precautions to be taken to prevent the occurrence of sparks at fractured electric cables, and also of arranging the line of electric leads so that it is as remote as possible from the gasoline mains.

Summary

The committee having examined the essential witnesses and having studied the reports of the Court of Inquiry and of the Admiralty Committee have arrived at the following conclusions:—

1. That the accident was due to structural weakness in the design of the airship.
2. That during the final flight no loads were imposed in excess of those which might have occurred during the normal navigation of the ship in weather which might reasonably be encountered.
3. That, having regard to her size and speed, R38 was considerably weaker than R33.
4. That no provision of specially powerful control surfaces of new design virtually accentuated this weakness.
5. That no calculations were made of the stresses due to the aerodynamic forces to which the ship would be subjected.
6. That in consequence, the calculations made by the design staff, taking specific account only of the forces and moments due to the distribution of weight and buoyancy, including gas pressures, were misleading.
7. That, owing to instability of the ship, combined apparently with overbalance of the control surfaces, the movements of the controls necessary to keep the ship on any particular course were comparatively large.
8. That the structure was not improbably weakened by the cumulative effect of reversals of stress of magnitude not far short of the failing stress.
9. That for the progressive development of airships in size, and speed reference to first principles in design is necessary, and that it is not sufficient to place exclusive reliance on comparison with existing ships.
10. That the existing methods of calculation at present in use for determining the scantlings of structural members of an airship are insufficiently accurate for this purpose and that more exact methods the outline of which can at present be indicated should be developed.
11. That research by both model and full-scale experiment is essential to determine and verify the forces to which an airship is subjected.
12. That the terms of the requirements laid down in time of war for R38 were extremely drastic, and that the limitations involved by the size of the shed in which the airship had to be built imposed too severe a task on the designers.
13. That at the time when the design was originally laid down information as to aerodynamic forces existed, which should have led to a more detailed consideration of the effects of these forces and to consultation with the Advisory Committee for Aeronautics as to the dangerous loads foreshadowed by the early model experiments on aerodynamic pressures.
14. That, in spite of the presence of a certain amount of softened duralumin in the airship, faulty material did not contribute to the accident.
15. That on the assumptions made, the structure was designed with great skill and the necessary calculations were carefully carried out by methods admitted as sufficiently accurate in other branches of engineering practice.
16. That the weather at the time did not contribute to the accident. The committee in this investigation have received help from many sources. In particular they would mention the staffs of the Royal Airship Works and of the N.P.L. who have provided much of the data relating to the Inquiry. The Committee were fortunate, also, in having present at their discussions and register their thanks to the two representatives of the United States Navy, Comdr. H. T. Dyer, and C. P. Burgess, the latter of the Airship Design Department.

"Who's Who in American Aeronautics"

The biographical sketches of men who are prominent in American Aeronautics are printed periodically in AVIATION. The first series will be shortly published in a more durable form, and revised issues will be published semi-annually to take care of the frequent changes in station of Army and Navy officers, and such other changes as may occur. As errors and omissions are liable to occur in a compilation of this character, interested parties are requested to notify "Who's Who" Editor of the necessary corrections so the record may be kept up to date.

Harold H. Emmons

EMMONS HAROLD H Lawyer born Detroit Mich. June 30 1875 son of Marcus A. Emmons and Alma M (Slaven) Emmons married Marian C Scotten, Feb. 19, 1910

Educated Detroit Grammar and High School University of Michigan Literary Department, 1897 Law Department 1899

Professional Walker & Spalding July-Oct 1899, Mayhury & Lucking Oct 1899 to Jan 1903 Member Mayhury Lucking Emmons & Helfman Jan 1903 to May 1913 Sec and Treas Regal Motor Co May 1913 to Jan 1917 Member Clark Emmons Bryant & Klein to date since leaving service Director Scotten Dillon Co., Guaranty Trust Co Signal Motor Truck Co Detroit Motorbus Co, Berry Bros Welded Steel Barrel Corp Diamond Specialty Co. of Detroit

Aeronautical Activities Chief of Engine Production Department Aircraft Production Board of the Army in charge of the production of all aviation engines for both Army and Navy

War Service Landsman Ensign Lieutenant (j g) and Lieutenant Detroit Naval Reserves Lieutenant Federal Naval Reserves 1917; retired as Lieutenant Commander

Honors Distinguished Service Medal, U S Honorable Mention British Government

Member Detroit Athletic Club Detroit Boat Club Detroit Golf Club Bloomfield Hills Country Club The Lawyers Club Delta Chi Legal Fraternity Detroit and Michigan State Bar Assns Sons of the American Revolution American Legion Military Officers of the Great War Society of Automotive Engineers Detroit Aviation Society Society of Colonial Wars

Present Occupation Attorney and Counsellor at Law

Address 4430 Cass Ave Detroit Mich

George Jackson Mead

MEAD GEORGE JACKSON Automotive Engineer born Everett Mass Dec 27 1891; son of George Nathaniel Plummer Mead and Jenny (Lehman) Mead

Educated St George's School Newport R I Choate School Wallingford Conn M I T 1911-1915.

Professional Engineer Sterling Engine Co Buffalo, N Y 1916 Experimental Engineer Simplex Automobile Co, 1916

Aeronautical Activities Wright-Martin Aircraft Corp New Brunswick N J 1917-1919 Engineer in charge Power Plants Laboratory U S Air Service Dayton Ohio 1919; Chief Engineer Wright Aeronautical Corp Paterson N J 1920 to date

Member Society of Automotive Engineers American Society of Mechanical Engineers Institution of Automobile Engineers London England Aeronautical Chamber of Commerce Vice Chairman of the Power Plants Sub-Division of the Aeronautical Division of the S A E Standards Committee Chairman of the Power Plants Sub-Committee of the American Engineering Standards Committee on Aeronautical Safety Code

Present Occupation Chief Engineer Wright Aeronautical Corp.

Address 238 Lewis Street Paterson N J home 14 Carleton Place, Glen Rock, N J

Robert Theodore Cronau

CRONAU ROBERT THEODORE 1st Lieut A S, born Kewanee Ill Aug 1 1896 son of Theodore Cronau.

Educated Kewanee High School, Texas A & M College Knox College

Aeronautical Activities School of Military Aeronautics Nov 1917 to Jan 1918 Kelly Field Jan 1918 to March 1918 Camp Dick, March to April 1918 Taliaferro Field April to Oct 1918 Garden City, Oct to Dec 1918 Carlstrom Field Dec 1918 to July 1919 Souther Field July to Oct 1919 Carlstrom Field Oct 1919 to April 1921 Langley Field April 1921 to date

Flying Rating Reserve Military Aviator March 11 1918 Airplane Pilot 1920

War Service Nov 1917 to Nov 11 1918

Present Occupation 1st Lieut A S 14 Aero Squadron (Heavy Bombardment)

Address Langley Field Hampton Va permanent 320 West Oak St. Kewanee, Ill

Harold G. Peterson

PETERSON HAROLD G, Commercial Aviation born Hutchinson Minn July 4 1894 son of S G Peterson

Educated Grade and High School Redwood Falls, Minn; Valparaiso University Architectural Engineering 1914-1917

Aeronautical Activities Built glider at Redwood Falls Minn and made numerous successful glides, 1912 built monoplane, engine not powerful enough for successful flight 1914-1915, enlisted as Cadet, Air Service Oct 27 1917 graduated Ground School, Champaign Ill Oct 27 1917 primary training, Chanute Field to Dec 15 1917 commissioned 2nd Lieut Ellington Field Feb 8 1918 instructor advanced acrobatics Ellington Field Feb 15 to July 1 1918 pilot, ambulance plane July to Oct 1918 finished night bombing course, Oct 1918 instructor R.M.A. stage accuracy and acrobatics, Nov 1918 to June 1919 Border Patrol 11th Aero Squadron Fort Bliss, June to Aug. 9, 1919 Flight B Marfa, Tex Aug 9 1919 forced landing 125 miles in Old Mexico near Pulbito on the desert captured by bandits Aug 10 held for ransom with Lieut Paul Davis Aug 19 for $15,000 at Candaleria Tex punitive expedition into Mexico, Aug 19 to Aug 24, 1919; member Flight A 104 Aero Squadron discharged Feb 28, 1920 Chief Instructor Federated Fliers, Inc Minneapolis Minn March to Dec 1 1920 Chief pilot and Instructor for Harold G Peterson Aircraft Co White Bear Lake Minn to date

Flying Rating Reserve Military Aviator Feb 8 1918 Airplane Pilot 1919 Aero Club of America Certificate No 7175 Sept 4 1918

War Service: Oct. 27 1917 to Feb 28 1920

Books Held for Ransom Colliers Weekly, by Peterson and Davis

Member Aero Club of Minneapolis Army and Navy Air Service Association

Present Occupation President and Chief Pilot Harold G Peterson Aircraft Co.

Address 65½ South 10 Street home Aero Club of Minneapolis Minneapolis Minn

Valentine Gephart

GEPHART VALENTINE, Aeronautical Engineer born Denver Colo, March 4 1898 son of George W Gephart and Edna V Gephart.

Educated Public schools of Denver, Colo

Professional 1915-1916 Harris Oil Co, Denver Colo, returned from army 1919 and opened up Aero Repair Depot, Kansas City Mo later incorporated as Valentine Gephart Inc for purpose of designing and building aircraft.

Aeronautical Activities Worked on old type Mathewson Biplane in Denver 1913 with Mr Hern of Hern Speed Propeller Co Air Service School, Becancourt, France, and assigned to 2nd A I C

War Service March 1917 to March 1919

Member Aero Club of America Kansas City Automobile Club

Present Occupation Designer of aircraft Vice President and General Manager International Aircraft Co

Address 119 Brush Creek Blvd home 3783 Washington St., Kansas City, Mo.

Walter C. Crowdus

CROWDUS WALTER C Aircraft Insurance born Chicago, Ill Feb 10 1895 son of Walter A. Crowdus and Louise (Wheelon) Crowdus

Educated Grammar School Hyde Park High School

Professional Salesman Golf Machine 1914 1915 Salesman Hacy Co Architectural and Engineering Supplies 1919 Rogers Brown & Co., 1919, Aircraft Insurance 1920 to date

Aeronautical Activities Ground School Univ of Ill Oct Nov 1917 Flying Cadet Love Field Dec 1917 to April 1918 2nd Lieut Instructor Love Field May June 1918 Asst Engineer Officer 6th Aero Squadron Pearl Harbor Hawaii

Flying Rating Reserve Military Aviator May 9 1918 F A I license No 1820

War Service Nov 1917 to Nov 11 1919

Books Various articles on Aircraft Insurance

Present Occupation Aircraft Insurance

Address 759 1st National Bank Building home 1510 East 52 Street Chicago, Ill

Jefferson Davis Jernigin Jr.

JERNIGIN JEFFERSON DAVIS Jr. Chief Quartermaster U S Naval Aviation born Commerce Tex., June 14, 1898 son of Jefferson D Jernigin and Zona Jernigin

Educated High school Emory & Henry College Emory Va

Aeronautical Activities: Ground School, Pensacola Fla. April 1917 French Army School Tours, France Sept 1917 French Naval School Lake Hourtin France Sept 1917 French Naval School, St Raphael France Oct. 1917 3rd Aviation Instruction Center A E F Issoudun France Dec 1917-Jan 1918 No 2 Auxiliary School of Aerial Gunnery R F C Turnberry Scotland Feb 1918 No. 1 School of Aerial Fighting R F C Ayr Scotland Mar 1918 U S Naval Air Station Dunkirk, France April-June 1918, Instructor U S Naval Air Station Moutchic France July-Aug 1918 Anti-Submarine Patrol Fromentine, France Sept 1918 Anti-Submarine Patrol U S Naval Air Station, Brest France Oct-Nov 1918 Aviation duty U S S Nevada, April-May 1919 Instructor and Tester, Naval Air Detachment Langley Field June-Aug 1919 Commercial flying Sept 1919 to May 1920 Naval Air Station Hampton Roads, Va May 1920 to date

Flying Rating French Naval Brevet, No 978 Naval Aviation Pilot Designation (No number one of first issued)

Member Aero Club of Texas

Present Occupation Chief Quartermaster U S. Naval Air Force

Address Naval Air Station, Hampton Roads, Va permanent c/o 1st National Bank, Commerce Tex.

Vincent Eaton Heywood

HEYWOOD VINCENT EATON Mechanical Engineer born Springfield Mass Jan 20 1889, son of Charles Henry Heywood and Cora M. Heywood married Gwenna M Crane June 9 1920

Educated: Lake Forest Academy, Lake Forest College

Professional Draftsman Commonwealth Edison Co., Chicago 1911 Draftsman C Barbisa Chicago 1912-1913 Mechanical Engineer U S. Envelope Co., 1913 and 1921 to date

Aeronautical Activities Trained at Tours, France as Cadet and ex-ambulancier trained at Issoudun (Chasse) at front, Mar 17 1918 Toul Patrol June 1918 St Mihiel and Argonne offensives with 99 Aero Squadron

Flying Rating Brevet d'Aviateur Militaire Française No 10,153 Junior Military Aviator

War Service: In American Ambulance Field Service from Dec 1916 commissioned 1st Lieut March 9 1918

Honors Croix de Guerre Honorable mention Lieut d'Hallery of R S N Sept 17 1917 for valor under fire

Member Aero Club of America Aero Club of Massachusetts

Present Occupation Mechanical Engineer

Address 75 Grove St home 12 Boynton St. Worcester Mass

Lester Frank Bishop

BISHOP LESTER FRANK, Air Mail Pilot born Le Roy Ill April 12 1889, son of Frank Bishop and Matilda Elizabeth Bishop

Educated Public schools and high school, Le Roy Ill

Professional Clerk Guard and Bishop Hardware Co. 1908-1909, Yard Man C A Pierce Lumber Co 1910 Auto Mechanic 1911-1914

Aeronautical Activities Mechanic, Champion Airplane Co Chicago, 1915 with Eddie Stinson and Robert T Shank 1916 Flying Instructor, Chanute and Selfridge Fields 1917 Instructor in Acrobatics Rich Field, 1918, Test Pilot Aircraft Production Detroit 1918 Air Mail Pilot Dec 27, 1918 to Dec. 1, 1919 Commercial Flying to Sept 15 1920 Air Mail Pilot to date

Present Occupation Air Mail Pilot

Address Air Mail Station Hempstead L I, N Y home, 702 Cedar St., Le Roy, Ill.

Properties of Two Aeromarine Aerofoils

Two High-Lift Wings Developed for Use on Large Aircraft. Particularly Adapted for Performance at Large Incidence

By B. V. Korvin-Kroukovsky

Technical Engineer, Aeromarine Plane and Motor Co.

I am indebted to P. G. Zimmermann, Chief Airplane Engineer of the company, for the permission to publish the properties of two Aeromarine aerofoils developed at the end of 1921. The object of the work was to produce an aerofoil suitable for use on large airplanes and on the flying boats, in the development of which the company is particularly interested. High lift with moderately high efficiency were therefore required, and particular attention was paid to the performance at large angles of attack. Incidentally it was desired to limit the thickness to 10 per cent of the chord, as USA27 aerofoil, being excellent aerodynamically, proved to be too cumbersome for use on machines with conventional biplane wing bracing.

The Aeromarine 2 Aerofoil

In the Rep. & Memo. No. 562 of the British Advisory Committee for Aeronautics a comprehensive series of experiments is described, showing the effect of different modifications of shape on the performance of aerofoils. It is on the basis of this information that leading dimensions of the Aeromarine No. 2 aerofoil were established, in all cases attention being given to all round performance, that is, to high maximum lift coefficient and good Lift/Drag ratio, both at small and at large angles of incidence. The position of maximum ordinate of upper surface was thus fixed at 28 per cent of the chord, the height of leading edge was made equal to 1 per cent of the chord, and the maximum ordinate of "Phillips entry" was placed at 5 per cent of the chord. The shape of the upper surface was detailed on the basis of comparison with several good aerofoils having flat undersurfaces. The thicknesses of aerofoils were reduced to the same value, and their shapes and performances were examined simultaneously. Due attention was given to the effect of thickness of aerofoil on its aerodynamical properties. The apparently best curve for each portion along the chord was adopted for the new aerofoil, thus completing the design of upper surface. The design of lower surface was less certain, as its shape differs more in case of different aerofoils, than the shape of upper surface. The investigation showed, that best results are apparently secured for this type of aerofoil by placing the maximum ordinate of the lower camber at 40 per cent of the chord, and by raising slightly the rear portion, beginning at about 90 per cent of the chord.

The wind tunnel test of the Aeromarine 2 aerofoil showed it to be almost identical with USA27, giving a little better efficiency at small angles of attack, and a little lower efficiency at larger angles of attack, with practically the same maximum lift coefficient and maximum Lift/Drag ratio.

The Aeromarine 6 Aerofoil

The Aeromarine 6 aerofoil was designed on the basis of experience gained with Aeromarine 2 aerofoil. It was desired to increase the maximum lift coefficient, and to make the thickness in the regions of front and rear spars more uniform. The shape of the upper surface of Aeromarine 2 was retained, but the camber was increased to about 12 per cent of the chord. The thickness at the rear spar was furthermore increased by decreasing the ordinates of the lower surface in that region. In order to keep the moderate thickness of aerofoil, the "Phillips entry" was reduced to 0.8 per cent of the chord, and was located at 3 per cent instead of 5 per cent. The increase of upper camber and thickening in the region of the rear spar are known to be detrimental to the efficiency of aerofoils. In order to maintain efficiency approximately on the same level, the thickness of the aerofoil was plotted on straight center line, and the shape of the resultant streamline strut was carefully faired. As the shape of the upper surface was already fixed, this determined the shape of the lower surface.

The wind tunnel test of the Aeromarine 6 aerofoil showed considerable increase of the maximum lift coefficient, accompanied by slight decrease of the best Lift/Drag ratio. There was, however, considerable increase of efficiency at larger angles of attack over both USA27 and Aeromarine 2 aerofoils.

It is of some interest to compare the properties of new aerofoils with the properties of older sections, such as USA4 and USA27, which were considered up to this time to be most suitable for heavy airplanes. The method of comparison of relative values of aerofoils is based on the assumption, that different wing sections are fitted to machines of the same weight and wing area. The value of aerofoil with regard to speed range is given by the expression

$$(L_{c\ max})^{1/2} \times (L/D)^{3/2}$$

where L/D ratio must be taken at the speed range desired. In this case we will assume speed ranges of 2.0 and 2.5, first figure covering all requirements for large machines, and second for best two seaters. For comparison of the rate of climb and ceiling we will take the expression suggested in the N.A.C.A. Tech. Note No. 73, namely

$$\frac{L_c^{3/2}}{D_c + 0.02}$$

and for the cruising radius the expression

$$\frac{L_c}{D_c + 0.02}$$

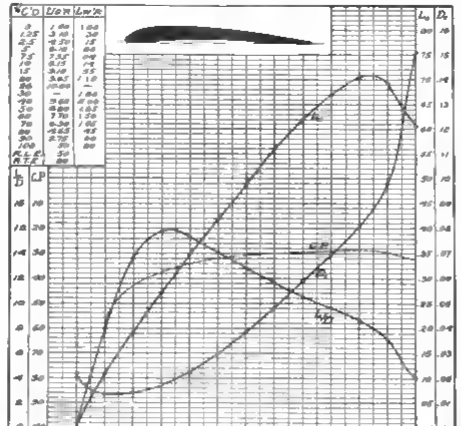


Fig. 1 Performance graph of the Aeromarine 2 aerofoil

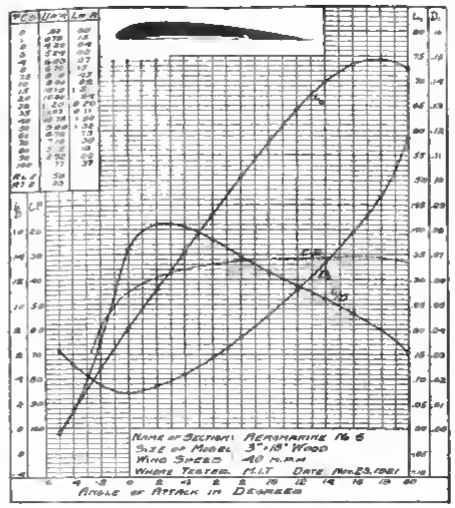


Fig. 2 Performance graph of the Aeromarine 6 aerofoil

the last two expressions being taken at their maximum values.

All four aerofoils were tested at the Massachusetts Institute of Technology, at wind speed of 30 m.p.h., with exception of the Aeromarine 6, which was tested at wind spred of 40 m.p.h. As wind speeds as high as 70 m.p.h. are available in that laboratory, and can be utilized in the future, the results of all tests must be corrected for comparison to some value of VL common to all. It will be convenient to choose the value of $VL = 40$, as this figure is higher than any one used in ordinary tests, and yet within the experimental range, so that correction can be applied with good degree of certainty.

The corrections were applied by the method suggested by Lt. W. S. Diehl, and the coefficients were computed by means of the expressions given above. These coefficients are tabulated below. The figures for USA27 are averages of the tests made in March and November, 1920.

COMPARISON OF AEROFOILS

Aerofoil	L_c max	Speed range Large Aircraft	Speed range Two Seaters	Climb and Ceiling	Radius of Action	Wing Depth in per cent of chord at 10 per cent	at 15 per cent	at 70 per cent
USA4	.745	1.92	1.55	7.37	10.01	5.01	5.80	4.38
USA27	.740	2.15	1.72	7.35	8.78	8.17	10.40	7.90
Aeromarine 2	.740	2.20	1.87	7.12	8.63	8.01	8.95	5.23
Aeromarine 6	.790	2.17	1.85	7.39	8.86	8.11	8.65	6.80

It will be observed that Aeromarine 6 wing section appears to be the best of the series for the machines with a speed range of about 2, that is practically for all large airplanes and flying boats. In this case its efficiency at high speed is only slightly less than that of Aeromarine 2, while its climbing ability is better than that of USA27. For smaller machines the USA27, Aeromarine 2 and Aeromarine 6 appear to be practically of the same value, the Aeromarine 2 being the best of the series for high speed, and the Aeromarine 6 for the climb and landing. It is possible, that in this case choice will be made on the basis of structural, rather than aerodynamical considerations. Thus for the machines with moderate span, when single-bay construction appears to be feasible, USA27 or Aeromarine 6 can be used, depending on actual proportions of the truss. For a two-bay machine, Aeromarine 2 section probably will prove to be more economical, weight of the ribs and fittings being taken into account. In this case its moderate thickness at the rear spar will be a valuable asset when fitting the ailerons.

Airplane Drill at Bolling Field

The first of a series of monthly airplane drills was recently held at Bolling Field, the occasion being the monthly inspection of the station by General Bandholtz, Commanding the District of Washington.

The program called for an hour's exhibition and was run off promptly, efficiently, and without a hitch. First on the program was a combat between Lieutenant Wolfe in an SE5, who attacked Lieutenant Maitland in a Fokker, the latter having just "opened up" on a Martin Bomber which was on its way to Philadelphia; then a radio exhibition by Lieutenant Beaton who read the morning news from his plane through a Magnavox and was told "how and when" to maneuver his ship by voice from the ground. Then came Lieutenants Smith, Boyd, and Van Veghten up the Potomac River in a beautiful formation of DH's on a bombing raid over a temporary village erected at the south end of the field. The alarm siren blew, the bombs dropped and the buildings collapsed. Two of them burst into flames. Three SE's took off in a hurry and chased the formation off, separated Lieutenant Boyd from the others and drove him to earth. In the meantime, Lieutenant Ramey had taken pictures of the fires and the field, including the spectators. They were developed and distributed before the people went home.

Attack Triplane for 90th Squadron

A GAX armored attack triplane, which has created much interest and comment among the members of the 3rd Group (Attack) at Kelly Field, has been assigned to the 90th Squadron. This ship, a design of the Engineering Division at McCook Field and built by the Boeing Airplane Co. of Seattle, Wash., is the first of several of these planes to be delivered for the use of the Attack Group. It is especially designed and constructed for the attacking of ground troops. In addition to being armed with machine guns, it carries a small cannon.

The power plant consists of two Liberty 12's set in a steel compartment, located in each wing. All vital parts are similarly protected with armor. The weight of the ship empty (including water) is 5,532 lb., and with crew, armament, and gas and oil 9,750 lb. The weight per horsepower is 11.2, absolute ceiling 11,500 ft. and service ceiling 9,600 ft. The rate of climb is 600 ft. per min. It takes a run of 285 yd. before it leaves the ground and rolls 326 yd. in landing. The overall span is 65 ft., 6 in., overall length, 33 ft., 7 in., overall height 14 ft. 3 in. The minimum speed at sea level is 63.6 m.p.h., and the maximum speed 105 m.p.h.

New Flying Field at Birmingham, Ala.

Birmingham, Ala., which is eighty-five miles from Montgomery, has completed a 60-acre flying field for the 135th Squadron, Alabama National Guard. The new field is located 2½ miles northwest of the center of Birmingham, near the Ensley Smelter. The field is marked with a T, and two hangars are being completed. The 135th Squadron is in command of Maj. James Meissner, formerly of the 94th Aero Squadron, and one of America's foremost aces. There are twenty-five other officers now in the squadron, all of whom have been flying officers in the Air Service of the Army, Navy or Marine Corps. The enlisted personnel is also well represented with mechanics who have had experience at Aviation Repair Depots and Air Service Mechanics Schools.

Maj. Roy S. Brown, commanding officer of the 22nd Squadron, made an interesting address to the officers and enlisted men of the 135th upon the work they had accomplished and the training they would receive in the new squadron. The officers and enlisted men making the flight were entertained at a luncheon given in their honor by the Optimist Club, and those who remained in Birmingham over night were entertained at a dinner at the Country Club, followed by a theatre party.

AIR MAIL SERVICE

Consolidated Statement of Performance

From May 15, 1918 to Dec. 31, 1921

Month	Trips Possible (Scheduled)	Trips Attempted	Trips Defaulted	Trips In-completed	Weather Encountered Trips in fog etc	Weather Encountered Trips clear	Mileage Possible (Scheduled)	Miles Travelled with Mail	Miles Ferry and Test	Total Miles Travelled	Per cent of performance	Mail Carried (lb)	Cost of Service	Forced Landings due to Mechanical	Forced Landings due to Other Causes
1918															
May, 15 days	40	51	7		31	20	6,750	5,324	1,010	7,324	78.87	4,750	$3,642.11	2	2
June	100	98	1		15	65	11,270	10,685	2,170	14,155	91.07	13,081	8,922.71	4	1
July	108	103	2		31	67	12,140	11,855	2,746	14,604	87.57	16,007	10,091.40	1	4
August	100	109	0		17	92	11,900	11,084	3,120	15,120	88.08	16,588	9,335.67	1	1
September	100	100	1		36	61	10,600	10,600	4,901	15,262	100.00	13,200	6,738.54	2	1
October	108	108	0		21	81	11,752	10,617	1,934	12,071	98.88	10,766	6,841.70	2	0
November	104	102	2		21	81	11,336	11,118	2,531	11,649	98.07	10,814	10,673.68	0	1
December	104	91	11		50	31	10,890	8,415	1,100	9,815	77.21	17,778	13,100.16	[illegible]	11
1919															
January	108	92	16		[illegible]	[illegible]	11,772	9,651	1,165	11,128	82.08	18,105	13,731.58	1	5
February	97	92	5		12	[illegible]	[illegible]	8,507	1,675	10,182	88.18	15,480	12,646.16	6	8
March	105	102	4		11	70	[illegible]	10,690	136	10,825	92.50	17,531	13,090.20	[illegible]	5
April	107	105	2		12	[illegible]	11,662	11,105	107	11,101	95.08	18,072	13,546.44	2	7
May*	146	141	1		62	81	23,298	22,578	649	23,207	96.92	20,020½	15,715.66	3	6
*Cleveland Chicago route inaugurated May 15, 1919															
June	160	160	0		46	111	31,041	30,815	15,147	15,958	10.6	15,647	10,901.62	1	4
July**	178	173	[illegible]		70	111	58,900	56,577	5,508	62,155	96.04	18,701	11,134.36	7	5
**New York Cleveland service inaugurated July 1, 1919															
August	178	171	2		5	115	58,916	58,022	11,071	69,081	98.41	8,870	10,414.79	5	6
September	157	171½			20½	111	57,104	56,204	8,478	61,718	98.80	[illegible]	14,481.13	5	8
October	158	165	11		65	101	58,782	50,118	10,091	70,410	[illegible]	7,400	15,093.02	11	10
November***	172	172	11½		41½	82	18,214	11,751	8,616	[illegible]	90.61	3,661	11,107.58	6	11
***November 1 Sunday service on New York Cleveland and Cleveland Chicago routes discontinued															
December	130	125½	10½		40½	87	48,820	35,708	[illegible]	11,187	71.61	11,510	14,091.26	18	8
1920															
January	106	125½ (113½ extra)	10		10½	81	40,120	33,942	6,506	10,418	69.8	43,125	12,551.60	16	10
February	148	115½	12½		18	40½	15,070	12,647	7,511	18,158	71.02	75,242	46,001.12	4	1
March††	210	179	31		18	111	49,018	37,481	9,129	18,090	71.27	47,181	44,785.71	12	8
April	208	180	28	0	85	95	48,121	31,890	[illegible]	17,441	65.16	42,006	55,535.10	28	7
May	212	211	21	5	58	111	50,670	41,114	10,411	51,597	80.72	71,112	57,001.81	17	11
June	250	204	26	11	33	110	[illegible]	31,067	12,506	48,463	80.11	58,005	[illegible]	30	6
July	280	273	7	7	10	215	[illegible]	69,140	1,160	74,002	96.85	68,401	[illegible]	25	14
August	368	347	21	10	[illegible]	[illegible]	[illegible]	73,150	12,587	118,023	92.42	73,140	73,029.91	9	20
September****	600	502	100	10	100	11	148,542	105,847	26,355	132,202	71.84	101,150	108,751.70	47	37
****Transcontinental service inaugurated September 8, 1920															
October	750	593	157	57	180	101	151,700	123,271	11,217	134,488	79.68	80,541½	123,016.66	51	78
November	758	575	183	71	210	115	158,076	114,781	25,600	[illegible]	78.70	87,302	121,591.18	85	69
December	884	662	222	105	317	115	178,158	127,108	3,744	111,040	71.21	80,942	131,207.06	89	178
1921															
January	850	697	153	47	251	441	151,119	132,610	6,050	138,660	77.18	84,425	134,488.01	117	171
February	783	660	122	71	40	750	179,224	130,441	14,224	118,665	81.00	88,125	121,855.12	82	122
March	918	871	47	50	751	720	185,852	173,591	15,072	188,625	92.42	110,117	152,442.27	61	127
April	884	837	47	56	70	467	158,778	171,150	15,204	186,050	95.53	117,718	147,890.04	70	177
May*****	850	[illegible]	17	20	120	415	171,000	168,107	12,810	181,210	97.96	115,023	125,754.74	72	11
*****May 31 1921—Last Day's service on New York Washington route															
June******	332	329	3	10	268	50	160,836	166,950	18,135	85,093	99.00	105,838	127,479.83	37	51
******June 30, 1921—Last Day's service on St Louis-Twin Cities Division															
July	624	623	1	8	65	558	131,450	[illegible]	14,120	148,681	99.31	71,276	109,769.11	34	29
August	603	560	4	17	129	560	126,071	138,549	14,883	149,432	98.22	84,660	106,686.68	32	30
September	637	631	6	8	160	171	127,708	125,011	22,185	148,080	98.58	88,401	102,906.45	18	28
October	714	707	7	7	160	541	110,084	138,750	20,212	158,961	99.05	80,057	122,205.51	23	41
Temporary service from Elko to Ely Nevada inaugurated October 10															
November	652	632	19	40	285	348	[illegible]	117,520	25,036	143,145	89.90	83,510	[illegible]	17	74
December	720	660	66	31	260	394	142,247	125,410	15,840	141,255	88.17	101,168	116,304.70	42	46
TOTALS	16,684	15,076	[illegible]	724	5,110	9,640½	2,470,855	2,052,026	471,994	2,525,020	87.96	2,109,643	$2,878,815.64	1,188	1,347

† Flight Washington to New York prior to July reported as two trips account exchange of mails at Philadelphia and subsequent to that date one trip [illegible]

†† Flight New York to Cleveland considered two trips (i.e. New York/Bellefonte and Bellefonte-Cleveland) from March 1, 1920

Operation of Airplanes over Forested Areas

A Review of the Activities of the U. S. Aerial Forest Patrol Service

It cost the government last summer $128,528.28 to operate airplanes over the forested areas of the States of California, Oregon and Washington, comprising 150,000 square miles, according to a report submitted by the 9th Corps Area Air Officer. The value of the timber protected in this area is estimated at $625,000,000, making the cost of protection afforded by the airplanes slightly over 2 per cent—a very small ratio, especially if the added value of the water sheds and other resources depending upon the forest protection are considered.

Of the total number of 1284 fires reported, 376 were reported by airplane before being reported from any other source. The total number of hours flown during the past fire patrol season was 277,717, and the mileage covered totalled 260,211.

Efficiency Greatly Increased

As far back as 1912 the use of aircraft for forest patrol has been given consideration as a valuable adjunct, on account of its superior mobility and range of observation. In 1919 the first protective flying activities over forested areas was started, and continued during 1920-21. The lessons learned in the previous years were applied during the 1921 season with gratifying results. Last summer the efficiency of the patrol increased noticeably, due to the experience of the observers in reading the topography of the country. Having acted in the same capacity the summer before and flying over the same territory, the observers had come to know the location of every saw mill and lumber camp, and no longer wasted time in trying to determine the source of smoke rising in spots where they knew smoke logically belonged. They knew the areas where men had received permits to burn brush and did not cause confusion at headquarters by reporting these licensed blazes.

A conception of the values involved in forest protection are made apparent from a letter received from Forester H. S. Graves, wherein he states that of the total forested area of the United States, about 550,000,000 acres, approximately 27 per cent is under government ownership and comprises National Forests, National Parks, Indian Reservations, Military reservations and unreserved public lands. Lumbering comes next to agriculture among the basic industries of the United States. Its importance is emphasized by the investment of two and one third billion dollars and its employment of over 900,000 men. The estimated value of the timber resources of the United States is more than six billion dollars. Statistics secured for the years 1915-1917, inclusive, indicate that the average damage caused by forest fires annually amounts to approximately ten million dollars. These statistics also show that there are upward of 28,000 forest fires annually in the United States, and that the average acreage burned over annually is more than eight million acres. The National Forests comprise 150 million acres and contain an estimated stand of timber of six million feet, board measure. A conception of this figure may be had in a measure when it is realized that the average annual cut in timber throughout the United States amounts to forty billion feet.

Some of the Handicaps

The operation of the airplane patrol during the past season was considerably handicapped. Due to a deficiency in Quartermaster appropriations, there was a shortage of gasoline and oil, rendering it necessary to temporarily suspend the patrol activities altogether during a period of the greatest fire hazard of the entire season. Inadequate personnel, resulting from the general reduction of the Army and lack of transportation funds made it impracticable to conduct the patrol to the extent planned, and even under existing conditions the personnel available were worked to the limit to continue the patrol. These difficulties were partly offset by the support and cooperation of the Forestry officials, States and municipalities. The States of Oregon and Washington both appropriated funds for the purchase of gasoline and oil, and it is estimated that the people of these two States spent approximately $75,000 in the preparation of landing fields, of which Oregon has, exclusive of small emergency fields, 10, and Washington 7. The number of fields in California totals 33. The Chamber of Commerce of Corning, Calif., provided a field and erected barracks at a cost of about $2,000. Alturas and Montague, Calif., furnished landing fields. An emergency field was prepared at Orleans in the Klamath Forest, also at Gravelly Valley in the California Forest and Fresno Flats in the Sierras.

The Forestry Service expended last year in connection with the forest patrol for salaries, landing fields, radio, telephones, etc., $19,450, to which must be added the purchase of 26,000 gal. of aviation gasoline for $7,670, and the payment of approximately $1,800 for freight charges on same, making a total expenditure of approximately $28,920.

Principal Sites of Operation

The patrol as put into effect covered the principal forests of California, Oregon and Washington, with bases at Eugene and Medford, Ore., Camp Lewis, Wash., Mather Field, Visalia, Corning and March Field, Calif.

An elaborate radio system was used with stations at all bases and important points, so that reports sent from airplanes could be checked up without delay and transmitted promptly to proper authority. Daily patrols were carried out regularly as far as weather conditions and supplies permitted, and special patrols were sent out as demanded by special fire hazards due to electrical storms, opening of the deer season, etc.

The Army Air Service utilized two squadrons on this patrol, the 9th and the 91st, comprising a total of 26 officers, 24 flying cadets and 466 enlisted men. There was a total of 25 airplane crashes during the season, resulting in four fatalities.

The following tabulation, showing losses sustained as the result of forest fires from 1917 to 1920, inclusive, forcibly demonstrates the fire hazard in the forested areas and the urgent need of adequate fire patrol measures:

Year	California Acres Burned	California Loss	Washington Acres Burned	Washington Loss	Oregon Acres Burned	Oregon Loss
1917	338,848	$148,471.00	Not available		Not available	
1918	170,276	68,948.00	Not given	$473,064.80	Not given	$988,[illegible]
1919*	207,431	87,043.00	Not given	478,670.00	Not given	478,670
1920	129,798	155,549.00	Not given	238,172.00	Not given	121,500

* Aerial forest fire patrol was begun in 1919

Advertising Value

The advertising value of the forest patrol must also be included. The presence of the planes without doubt impressed the people with the efforts that were being made to prevent forest fires and also made them more careful to avoid starting fires. The use of aircraft in actual fighting of forest fires was of special value in that a complete survey could be made of the fire and plans drawn up to best accomplish its control. The element of time in forest fire patrol must be given great weight in cases such as immediately following an electrical storm in which the airplane shows its value in being able to cover in a short time a large area and check up all incipient fires.

In the operation of the patrol of the Coronado National Forest in Arizona, the estimated cost of same for the fiscal year 1922 is given as $3,010, hours flown 148½, number of fires discovered and accurately located, 7, and the cost in excess of normal flying $1,647.96.

A larger forest fire patrol project for next season has been worked out in detail and carefully considered, both by the

Air Service and Forestry officials. This project contemplates an additional base at Missoula, Moot, and sub bases at Spokane, Wash.; LaGrande, Ora., Boise, Idaho; Cody, Wyo., and Helena, Mont. This extension would include a patrol of the principal forested areas of the States of Wyoming, Montana and Idaho. The project involves the utilization of 5 squadrons, 160 officers, 660 enlisted men and 90 airplanes, at a total cost of $2,641,790.

The report goes on to say that there is apparently no effort being made at the present time on the part of any Governmental department to push the matter of forest patrol for the coming season. The Forestry Bureau has stated that under existing conditions they do not contemplate the use of aircraft but will confine their efforts and funds to ground observation. The Interior Department plans do not involve use of aircraft in protection of forested areas for which they are responsible. With present funds, equipment and personnel it is impracticable for the Air Service to carry on forest patrol without discontinuance of proper Air Service functions. Any decided pressure brought to bear for an aerial forest patrol will probably come from the private interests of the Northwest, California being excluded, for the reason that the great majority of timber lands in that State is government and not privately owned.

Notices to Aviators

Issued by Hydrographic Office, U. S. Navy

North Carolina

Facilities for the operation of seaplanes—The following information concerning facilities for the operation of seaplanes at the below mentioned ports has been received from the commandant of the United States naval air station, Pensacola, Fla., under date of Nov. 2, 1921.

Southport—Latitude 33° 55′ N., longitude 78° 01′ W.

Anchorage—Good anchorage in depths of 2 to 25 ft. Beach is unsuitable in general for docking planes.

Supplies—Gasoline may be conveniently obtained from a gas-filling station conspicuously located at the end of a dock. No aviation supplies are available.

Communication—Telegraph.

Morehead City.—Latitude 34° 43′ N., longitude 76° 43′ W.

Anchorage—Ample anchorage in Bogue Sound with good holding ground, average depth of water about 6 ft. Shelter may be obtained from winds from all directions. The beach is generally suitable for docking seaplanes.

Supplies—Gasoline may be conveniently obtained from a gas-filling station, supplies are available.

Communications—Telegraph—Navy radio station.

NOTE.—The United States Coast Guard Aviation Station at Morehead City has been placed out of commission. (N. A. 12, 1921.)

South Carolina

Charlestan Harbor—Seaplane facilities.—The following information concerning facilities for the operation of seaplanes at the port of Charleston has been received from the commandant of the United States naval air station, Pensacola, Fla., under date of Nov 2, 1921:

Charleston—Latitude 32° 48′ N., longitude 79° 55′ W.

Anchorage—There is ample anchorage room in water varying in depth from a few feet to 40 ft., the beach in general is unsuitable for docking planes. Much drift wood is in the harbor and must be carefully avoided in landing.

Supplies—Gasoline and oil may be obtained from the Standard Oil Docks across from the north end of Drum Island, or by arranging for boats to carry gas out to drums. The Standard Oil Dock is somewhat high and difficult to approach.

Communication—Beside the telegraph, there is a commercial radio station in Charleston in addition to the radio station at the navy yard. (N. A. 12, 1921.)

West Virginia

Charleston—Landing field—A rectangular landing field 900 by 200 ft. is located 1½ miles south of Charleston, near and parallel to the Kanawha River, long axis northwest-southwest.

The field contains a hangar and is marked with a "T". Prevailing winds are from the southeast.

High voltage telephone lines follow the road on the north side.

In event of landing with too much speed it is possible to roll over the road to the southeast. (N. A. 12, 1921.)

Express Co. Ready to Contract with Airways

An Address at the Aviation Executives' Luncheon on Requirements for New York - Chicago Line

In the opinion of R. E. M. Cowie, vice-president of the American Railway Express Co., the time has arrived for a New York Chicago airplane express service, and Mr. Cowie's company will aid such a service with its widespread collection, distribution and advertising resources. These statements and others of equal interest to the aeronautical industry were made by Mr. Cowie at the semi-monthly luncheon of aviation executives at the Cafe Boulevard, New York, last Friday. As a practical transportation executive Mr. Cowie's talk was made up of plain facts and fundamental business truths of extremely practical application to any air transport project.

Conceding the engineering and organizing ability of the American aircraft industry, once its present inertia is overcome, he pointed out what he considered the tremendous latent possibilities in a regular and dependable air express and mail service between New York and Chicago. Adequately capitalized and properly organized along modern public utility lines, with sufficient reserves to operate regardless of pay loads until public confidence and support is forthcoming, such a service would soon establish itself on a paying basis. "But," said Mr. Cowie, "the only thing which will insure success is daily performance approximating that of the Twentieth Century Limited."

Such a service could count upon the active support of the American Railway Express Co. with its widespread collection, distribution and advertising resources, and in Mr. Cowie's opinion profitable mail contracts would undoubtedly follow a successful demonstration of fast and dependable service.

Urges Cooperation of Industry

New business is created first by having something of special utility or service to sell, and it has been the history of transportation from the beginning that each major improvement develops an entirely new class of business. The possibilities of the airplane in this direction are unlimited, in Mr. Cowie's opinion and the airplane industry should get together at once and organize a New York-Chicago service as a practical demonstration to the Government and the public. Europe with its comparatively short distances and disadvantages of climate, separate races, social and financial depletion and artificial barriers has already far outstripped America with every natural advantage on its side.

Mr. Cowie believes that passenger transport by airplane should be undertaken only after successful demonstration of a mail and express service. Planes specially designed with relation to the business sought, a survey of airdrome facilities of the route and the physical characteristics of the territory to be flown over were the first requirements.

Mr. Cowie recounted two discouraging experiences which he had encountered in connection with tentative air express transport. Two years ago representations were made to him as to the practicability of a non-stop express service between New York and Chicago. As a result Mr. Cowie was instrumental in having a Handley Page loaded up with a ton of express at New York for a non-stop flight to Chicago. The machine was forced down at Syracuse and although it made a skilful landing on a small race track, and later limped as far as Cleveland, as a practical demonstration of air express service the flight was unconvincing, as the express matter had to be unloaded and carried to the Cleveland express station by trucks where it proceeded by more prosaic train.

Must Make Night Flights

Night flights between Chicago and New York with express offered the greatest immediate possibilities if operated with airplanes capable of a pay load of from one to two tons, which would leave Chicago and New York each evening and complete their flights early next morning. The express matter would be transferred to fast trucks which would deliver the packages to consignees in either New York or Chicago at the opening of the business day.

Mr. Cowie stated that the best express service that can be given by rail is by night express trains running on schedules nearly as fast as the Twentieth Century Limited. This service now consumes 36 hr. That is, a shipment collected some time on Monday would leave for New York or Chicago on the night express train, arriving at destination Tuesday night, with express deliveries Wednesday morning.

Express Company's Assistance

With the facilities of the American Railway Express Co. behind a properly organized air transport company, the express company would advertise the air line on its trucks and wagons, and do everything reasonable to create a new kind of fast express business. Special collections would be made during the day, and the packages placed in numbered hampers at the collection centers which would be routed to the delivery districts at the city of destination. By fast trucks these hampers would be carried to the airdrome and placed intact in the plane. At destination the process would be reversed. This system would bring a parcel to consignee the following morning at the opening of business, as well as gain a day for a shipment destined to further rail points.

While no attempt was made by Mr. Cowie to outline the ground facilities, special equipment, and organization necessary, he emphasized the necessity of an organization sufficiently strong financially to provide not only the initial physical equipment but also to operate at a loss if necessary in order to demonstrate regularly, and so secure the necessary confidence of the public. Such an organization could be built up within the aeronautical industry itself, if the larger aviation interests would get together on a cooperative basis to form one operating company and concentrate every effort on making a confidence building demonstration. Capital for extending the initial service would quickly seek investment as it has always done where a new business has shown its earning possibilities.

Pending national air legislation would of course help materially to create the proper background for successful air transport, but it appeared to be Mr. Cowie's opinion that immediate steps should be taken by the airplane companies to organize their resources now and begin practical operation at the earliest possible date. With such evidence of enterprise and teamwork, government cooperation through mail contracts, airdrome facilities and municipal assistance would follow closely.

Railroads Encountered Worse Difficulties

Mr. Cowie further pointed out that air transport has many initial advantages over older forms of transportation. He cited as an example the early pioneer efforts of the railroads and the tremendous inertia and even ridicule they had to overcome. The airplane companies with no pioneer engineering surveys to make, no rights of way to acquire, and no road-beds to maintain, with an absolutely free medium in which to operate and with the advantage of a highly organized industrial area, have only minor initial problems compared to those encountered and overcome with less resources by the early rail interests.

Airplane traffic is at hand actually clamoring to be flown, as soon as proper facilities are provided, while the pioneer railroads had to make tremendous capital investments before taking in a cent in traffic. James J. Hill, the Great Northern empire builder, gave away lands, cattle and seeds to farmers to create traffic for his wilderness piercing road.

The government parcel post illustrates the flow of new and undreamed of traffic which follows the creation of a parallel public utility. Instead of putting the express companies out

of business the parcels post service has created a new class of business which the express companies could not handle profitably considering the government's ability to tax the individual citizen to make up any deficit.

Exclusive Mail Contracts

Granting the immediate organization of one large operating company by the airplane interests for express and mail service between New York and Chicago, Mr. Cowie believed that the Government could be convinced of the advantage of making an exclusive term mail contract with that one company in order to insure its success. One such successful demonstration would of course quickly lead to the establishment of a commercial aviation industry and the reserves in trained personnel and industrial resources which the government requires for national defense.

With President Harding recommending a ship subsidy, and bills now in Congress to make his recommendations effective, Mr. Cowie thought that the supposed opposition to subsidies by the American people was largely imaginary. He showed that we already have indirect subsidies in mail contracts and in the innumerable aids to navigation installed, operated and maintained at government expense. Similarly Mr. Cowie thought it would only be a matter of demonstrating to the government the service and material value of air transport when equal aid would be given the new form of transportation.

Air Service Reserve Group, Chicago

A group unit of the Air Service Reserve has just been organized in Chicago. The group has as ranking officer Capt. Philip G. Kemp, and consists of the following units:

311th Observation Sq., 321st Balloon Co., 307th Attack Gr. Hdq., 337 Air Pk. (307th Attack Gr.), 338th Air Pk. (308th Pursuit Gr.), 423d Pursuit Sq., 338th Air Pk., 311th Photo Sec., 407th Photo Sec., 309th Attack Gr. Hdq., 467th Attack Sq., 429th Photo Sec., 368th Balloon Co., 349th Air Park.

Ranking officer of the Chicago group is Capt. Philip G. Kemp. Other officers are:

In the 311th observation squadron, Second Lieutenants Alfred K. Kratky, Thomas C. Corbett, W. K. McCraken, Reginald C. Kuhn, Charles B. Daggett, Bernard R. Garner, Richard E. Ailsworth, Dana R. Simpson, Clinton E. Pardridge, James R. Gibson, Otto W. Grafe, Ralph R. Arnheim, Benjamin H. Drolinger, John Groener, Elmer W. Reitz, William S. Hedges, Waldo T. Johnson and Albert C. McCaleb.

In the 321st balloon company, First Lieutenants Dunlap C. Clark and William Seick, Jr., and Second Lieutenants William B. Gemmill, Fred L. Faulkner and Meyer Morton.

In the 307th attack group headquarters Capt. Charles A. Reid, First Lieut. Francis H. Miller and Second Lieut. Clement O. Geisler.

In the 337th air park (307th attack group), Second Lieutenants Louis M. Beitler, Alfred C. Carrier and William H. Wright.

In the 338th air park (308th pursuit group), Capt. Fred M. Byerly, First Lieutenants Ralph L. Shannon, Wilbur T. Emerson, Second Lieutenants Arthur E. Johnson, George C. Lorentz and Paul F. Barbisan.

In the 423d pursuit squadron, First Lieutenants John W. Schroeder, John H. Skonigg, Marcus D. Richards, Nelson D. Barnett, Eugene N. Bergland, Joseph S. Pliska and Arthur H. Stanton, Second Lieutenants Guy K. Rudd, Richard M. Bell, Samuel A. Blair, Ralph H. Hetzel, August W. Wilhsch, Frederick H. Chetlain, Will C. Seivert, Gene Fogle, Arthur E. Becker, William C. Bausch, George T. Condron, Francis D. Greene, Arthur M. Gulhekson, William E. Rownes, Edward H. Gnmbert and Edward W. Krueger.

In the 338th air park, First Lieutenants Henry T. Hemming and S. F. Norman, and Second Lieutenants Louis F. Mongrieg, Norman McKinney, Raymond R. Rehm and Robert C. Preble.

In the 311th photo section, Second Lieut. James C. Keogh.

In the 407th photo section, Second Lieut. Kenneth Dennett.

In the 309th attack group headquarters, Capt. Philip G. Kemp, First Lieut. Joseph L. Whitney and Second Lieut. Kent A. Alcorn.

In the 467th attack squadron, First Lieutenants Walter A. Stahl, Sidney J. Bovey, Robert C. Payton, Keith Jones and Herman H. Woeltjen, Second Lieutenants Cyril J. Goodman, Elsdon L. Maynard, Frank Stoll, Nicholas B. Cluck, Jr., George H. Pemberton, Sidney Levy, Norman E. Westfield, John L. Eddy, Andrew B. Bass, Walter A. Bowers, Wilhelm A. Hansen, Marvin W. Thompson, Herbert C. Landsell, Robert C. Wilson, Walter Merker, Robert H. Matthews, Edwin H. Kinney, Joseph R. Grrico and James Wulpi.

In the 429th photo section, Second Lieut. Leo Leonard.

In the 368th balloon company, First Lieut. McDonald C. Lovell and Second Lieut. Roger F. Howe.

In the 349th air park, First Lieut. Leslie M. Parker.

Easter Airways, Inc., Organized

Transportation by flying boat between Baltimore, Md., and Norfolk, Va., a distance of approximately 180 miles, is the purpose of a Baltimore company recently chartered by business men of that city under the name Easter Airways, Inc., of which P. E. Easter is president. Announcement of the projected service was made last week by H. A. Bruno, advertising and sales manager of the Aeromarine Engineering & Sales Co., who have just sold to the Easter Airways two Aeromarine Navy HS flying boats.

Mr. Easter is a former Army flier who during the winter months of 1920-1921 operated a small two-place boat at St. Augustine, Fla. In the spring of 1921 he returned to Baltimore and realizing that he needed more efficient equipment, he purchased one of the six-seater, open cockpit Aeromarine-Navy HS flying boats powered with a Liberty engine. During the summer Mr. Easter made many regular trips from Easter to Baltimore, demonstrating the safety and practicability of flying boat travel. Operations were suspended during the winter, but as a result of the interest aroused among prominent men in Baltimore, there was formed the Easter Airways, Inc. The directors of this company are big business men of Baltimore. Following the increased capitalization, Mr. Easter placed his order for two additional Aeromarine-Navy HS flying boats.

"While it is too early at the present time to definitely state our plans," said Mr. Easter recently, "we have in mind the operation of a regular line between Baltimore and Norfolk, taking in also the eastern shore of Maryland.

"My reason for continuing to use this type of flying boat was because of the excellent way the first one has performed, and also because I realize that there is no flying boat on the market today that can compare with it for low cost of operating and earning possibilities.

"While I must admit I have been influenced in making this second purchase to a great extent by the splendid performance of my first boat, I wish to state also that the way the same type boats have performed in their operations for the Aeromarine Airways has doubly convinced me that I have made a good deal for all concerned.

"Over water flying has a fascination and a charm for the general public which makes it easier for us to secure passengers. Our operating bases will be at strategic points and our cost of securing passengers will naturally be much less than if we were located at some inaccessible points.

"Mr. Redden, President, and Mr. Bruno of the Aeromarine Co., have gone out of their way to give me the benefit of the experience gained in the operation of the Aeromarine Airways. I have found them eager to suggest and advise. I do not think that there is any other company in the United States today that has the operating details and information that the Aeromarine Co. has, and they are sincere in their desire to pass this information on to the owners of Aeromarine boats.

"I am exceedingly optimistic as to the future of commercial aviation, particularly, in relation to flying boats. While I do not hold out any extraordinary hopes of making a great deal of money without any work, I do feel that a commercial aviation enterprise (using proper equipment and with the right kind of personnel) is a good business proposition."

Correction -- The Roma Picture

In the last issue of AVIATION there was published on p. 281 a picture of the Army airship Roma as she was believed to have appeared "shortly before the accident." The caption called attention to the angle the elevator-rudder cell was making with the horizontal fin, from which the inference was drawn in the text of the accompanying article that this was an abnormal position.

However, a careful examination of the original photograph, and reference to other photographs of the Roma, reveals the fact beyond any question of doubt that the elevator rudder gear of the ship was not out of alignment. First, the ship, being moored to the ground by a cable which is not visible in the illustration, is either keeling over in the direction of the camera, or else the picture was taken from below at such an angle that the ship appears keeling over. This becomes obvious with reference to (1) the lower portions of the first and second engine nacelles of the offside which may be seen protruding below the keel, (2) the large portion of the nose and front end of the keel which are visible, and (3) the fact that the top vertical fin, aft, is invisible. The latter fact alone would prove that the ship is shown keeling over at a considerable angle.

Second, the erroneous assumption that the elevator-rudder was out of alignment was due to its reference to the "horizontal" fin. On the Roma, however, the "horizontal fins" are, unlike on most other airships, *not horizontal*, but are set at a cathedral angle, that is they are depressed below the horizontal. Such being the case, it becomes obvious why the horizontal surfaces of the elevator-rudder should make an angle with the "horizontal fin" and yet not be out of alignment, whether the ship is keeling over or not.

This should dispose of any assumption that the elevator-rudder of the Roma was out of alignment on this picture, but it also goes to show how difficult it is to judge the position of the tail planes from the ground, and the care which should be exercised in the questioning of witnesses.

Indiana National Guard Squadron

The 137th Observation Squadron, Air Service, Indiana National Guard, located at Kokomo, Ind., has received two new government steel hangars, and a contract to erect them complete, with concrete floors, has been let by the State, erection work to start at once.

This squadron is the first Air Service unit to be federally recognized in the Fifth Corps Area, and one of the first in the United States. The unit occupies the 100-acre flying field, owned and operated by the Curtiss-Indiana Co., which has one of the largest and best equipped flying fields in this country, being credited with 50,000 miles of flying with their twenty-seven ships in the past year.

The squadron is under the command of Maj. Wilber M. Eagley, and the officers are nearly all ex army fliers. The enlisted personnel is composed of men picked from the automobile plants and other factories in Kokomo, and they are particularly well fitted for the various technical duties in connection with an organization of this type. The interest shown in this unit is evident from the fact that the total strength has increased 43 per cent during the last month, bringing the enlisted strength up to 127.

Camp Nichols, P. I., now an Air Service Station

The clearing house for Philippine Scout recruits for years—Camp Nichols, P. I.—has been converted into an Air Service station. The Quartermaster Corps is employing a gang of natives to clear as much of the camp as is to be converted into a flying field.

The field is of an L shape, the foot of the L being slightly over 500 yd. in length and the leg of the L something over 650 yd. in length. By having this field and also the field to be constructed on Corregidor, all heavier-than-air craft will then be able to fly between, and land at, all stations.

Safe Flying in Fog

The very latest idea for flying through fog is a wireless compass which can be set to any destination. The pilot will grope his way down to the airdrome by an arrangement of intersecting searchlight beams, the height of the point of intersection of the beams above the airdrome being known by the pilot. This is the idea of Sir Arthur Whitten Brown, navigator to the late Sir John Alcock on his transatlantic flight, who states that the wireless compass will be worked by directional wireless, the compass tuning in with a ground wireless station. Thus, if a pilot wants to fly from London to Paris, he sets the compass in tune with the Le Bourget (Paris) wireless station, and then he steers by this compass through the fog—or above it when possible—and he will find himself in due course over the Paris terminal.

In practically all fogs the airplane pilot finds clear weather before 1000 ft. up, and experiments have recently been conducted successfully at Croydon with an instrument for ascertaining the height of the fog. This instrument is sent up on a small balloon, and on it is a brass ring. As long as the instrument is in the damp fog the ring is held in position, but as soon as it gets above the fog into clear, dry air, the catch holding it contracts and the ring slides down the string. The amount of string paid out is measured, and this gives the height of the fog. It is expected that by next year fog will not in any way interrupt the air liners.

Order for Douglas Torpedo Planes

Rear Admiral William A. Moffett, Chief of the Bureau of Naval Aeronautics, has placed with the Davis-Douglas Co. of Los Angeles an order for the construction of eighteen Douglas torpedo planes.

Contrary to a rumor current in the industry, this order was not placed with the Naval Aircraft Factory in Philadelphia, but the latter will build six Douglas bombers, while eighteen additional machines of this type will be constructed on competitive bids.

New Invention in Aerial Photography

A recent invention by F. M. Huddleston, of Los Angeles, Calif., is creating considerable interest in aero-photographic circles. The Aerograph, as this invention is called, consists of a small pilot balloon from which is suspended a combination gyroscope and gimbal for holding the camera, together with electrical devices for controlling its operation. Absolute control is had from the base, which consists of a truck upon which is installed a winch and hydrogen generator, as well as a control board.

Coming Aeronautical Events

AMERICAN

Apr. 30 — ***Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.***

May — ***National Balloon Race.***

Sept. 4 (about) — ***Detroit Aerial Water Derby, Detroit (Curtiss Marine Flying Trophy Competition.)***

Sept. 15 (about) — ***Detroit Aerial Derby, Detroit. (Pulitzer Trophy Race.)***

Sept. 30 — ***First Annual Interservice Championship Meet. (In preparation.)***

FOREIGN

Aug. 1 (about) — ***Coupe Jacques Schneider. (Seaplane speed race.) Italy, probably Naples.***

Aug. 6 — ***Gordon Bennett Balloon Race, Geneva, Switzerland.***

Oct. 1 — ***Coupe Henri Deutsch de la Meurthe. (Airplane speed race.) France.***

American eliminating trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

Foreign News

Germany

Over tbe Berlin-Auguburg air ronte, whieb the Rumpler Co. have been exploiting, tbe totals for 1921 are given as 1244 passengers and 3286 kg. of mail carried.

From Berlin it is reported that tbe Moscow Soviet has approved a draft agreement witb a German air line company for a regular service of postal and passenger airplanes between Moscow and Berlin, via Kovno and Königsberg. It is added that the Lithuanian and Lettish Governments have given their assent to the scheme.

Japan

The American Consnl at Nagoya, H. F. Hawley, writes as follows on the progress of aviation in Japan:

American aircraft manufacturers should follow closely tbe developments in Japan, as considerable activity along the line of airplane construction indicates an increasing demand for such means of communication and possible opportunities for sale of airplanes.

The estahlishment of an aerial training school in Nagoya and tbe organization of the Lake Aerial Exenrsion Co. is contemplated hy a civilian aviator of Kyoto. The latter is planning a visit to the United States for the purpose of purchasing a 400 hp. 8 seater plane.

The reopening of a civilian aviation school at Nagoya, which was temporarily closed, is being planned.

The Mitsnhishi Motor Co., at Nagoya, has made progress in the work of mannfacturing its new type of airplane, and will soon be turning ont complete machines. The company's application for permission to estahlish an aviation field in front of its works at tbe port has received official sanction.

A trial flight with an experimental airplane completed hy these works, in which a 300 hp. Hispano-Suiza motor was instalIed, sbowed satisfactory results. The airplane was constructed after the plans of a British engineer; while the details of construction are kept secret, it is said to be a bigb-speed figbting plane, to be known as tbe Mitsnbishi type. The company plans to nndertake construction of this type of biplane.

Work has been started hy the Aichi Clock & Electric Machinery Co., Ltd., on tbe construction of a factory in the neigbborhood of Nagoya to wbich the works of the company now at Atsuta, will be moved. It is expected that the factory will be completed by tbe end of 1922. The present works are capable of turning ont one airplane a month, of the Yokosbo type; the new factory will bave a capacity of fifty planes a month. Besides the mannfacture of airplanes for military pnrposes, special attention will he given to tbe prodnction of large commercial planes.

The Kawasaki Works of Kohe are contemplating the erection of airplane factories in the Gifn Prefectnre. Construction was schednled to be started in November, 1921, and to be completed in the spring of 1922, when 500 workmen will be detached from Kobe to engage in the manufactnre of airplanes.

Norway

The American Consul at Christiana, Alhan G. Snyder, reports that the Norwegian Naval Aircraft Factory has recently tried ont a new type of monoplane wbich was begun in Marcb and carries a motor of 225 hp. Three other machines of the same type are expected to be finisbed at the rate of one a montb. Monoplane F52, as it is called, is entirely Norwegian built, carries fonr passengers, and is adapted for civil as well as for Naval flying. It attained a speed of 160 k.p.h. and rose to an altitnde of 1000 m. within 7 min. The same factory has built an airplane to run on skis, which is said to have been very successful.

The army is priding itself on tbe prodnction of a new type of airplane FF9, wbich was snccessfnlly tested and attained a speed of 135 to 138 k.p.h. The landing speed of this new macbine, which is the first of a series of ten and is bnilt by the Army Aero-Factory, is 85 k.p.h. Some of the other machines of this series will he fitted with thick profile wings.